

Patent
Attorney Dkt. No.: LYNN/0096

IN THE SPECIFICATION

Please delete the last two paragraphs that start with "Figure 1" and "Figure 2" respectively, on page 7.

Please insert the following new paragraph after the first paragraph under the header **BRIEF DESCRIPTION OF THE DRAWINGS** that ends with "equally effective embodiments."

FIG. 1 is a schematic drawing of an ice maker capable of operating at high turndown ratios with reduced power consumption.

Please insert the following new paragraphs starting on page 17 before the heading of Example.

FIG. 1 is a schematic drawing of an ice maker capable of operating at high turndown ratios with reduced power consumption. The ice maker 10 includes an evaporator drum 11, a compressor 12 for circulating refrigerant, a condenser 13 for condensing the refrigerant pumped by the compressor 12 and a receiver 14 for storing the liquid refrigerant until required by the evaporator 11. The liquid refrigerant flows from the receiver 14 to the evaporator drum 11 through an expansion valve 15 that opens and closes to maintain a constant pressure within the evaporator 11.

A level of water 21 is maintained in a pan 22 to provide suction to a pump 23 that circulates the water 21 through a series of nozzles 24, 25, spraying the water 21 onto the outer surface of the rotating evaporator drum 11. The evaporator drum 11 rotates so that the water 21 sprays onto the entire circumference of the evaporator drum 11 as it rotates at the outlet of the nozzles 24, 25. Ice forms on the outer surface of the evaporator 11, which can then be harvested by a scrapper (not shown). The ice forms on that portion of the evaporator drum 11 wetted by the refrigerant, i.e., below the refrigerant level 27 in the evaporator drum 11.

The water 21 spraying on the evaporator drum 11 provides the heat load to the refrigeration system 10, causing the refrigerant 27 to evaporate and flow to the suction of the compressor 12. As the refrigerant 27 evaporates, the expansion valve 15 opens to maintain the pressure and the refrigerant level within the evaporator drum 11.

The controller 31 monitors the refrigeration system 10 and the power grid 32 and adjusts the

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refrigeration system 10 to match the available power from the power grid 32. Instrumentation 33 on the power grid provides the controller 31 with information concerning, for example, the total amps being delivered to the grid, the total amps being drawn from the grid, the voltage across the grid, the maximum current that can be supplied to the grid from the generators and other relevant information as known to those having ordinary skill in the art. Other instrumentation 34 provides the controller 31 with information concerning electrical supply to the compressor 12, such as the current being drawn by and the voltage being supplied to the compressor 12. As the voltage on the power grid or to the compressor 12 drops below a setpoint or as the current flowing onto the grid or leaving the grid exceeds a setpoint, the controller 31 reduces the capacity of the compressor 12 to decrease the power consumption of the compressor 12. The controller 31 may adjust the variable speed motor 35, activate one or more cylinder unloaders 36 to unload one or more cylinders on the compressor, or a combination of both to reduce the pumping capacity of the compressor 12 and thereby reduce the power consumed by the compressor 12.

At the now reduced capacity of the compressor 12, the refrigerant evaporation rate is greater than the refrigerant pumping capacity of the compressor 12, causing the pressure in the drum evaporator 11 to increase. As the pressure increases, the expansion valve 15 closes to maintain a constant pressure within the drum evaporator 11 by limiting the amount of refrigerant that can flow into the evaporator 11. As a result of less refrigerant flowing into the evaporator 11, the refrigerant level 27 drops, decreasing the effective heat transfer surface area where the ice is formed. Since the effective heat transfer area is reduced, the refrigerant evaporation rate decreases to establish a steady state operation so that the refrigerant compressor 12 pumping capacity matches the refrigerant evaporation rate. Optionally, the system may include a low-pressure reservoir 26 selectively open to the suction of the compressor 12 through a solenoid valve 28 activated by the controller 31 so that the liquid refrigerant may be evaporated into the low-pressure reservoir instead of increasing the load on the compressor 12. The vapor refrigerant may then be removed from the low-pressure reservoir during periods of higher pumping capacity.

The controller 31 may also control the spray nozzles 24, 25 and the water circulation pump 23 to control the heat load on the drum evaporator 27. If the pressure in the evaporator 11 increases, the controller 31 may slow the speed of the water circulation pump 23, if it is driven by a variable speed motor, or the controller may turn the pump off to reduce the heat load of the water being

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sprayed onto the surface of the drum evaporator 11. The controller may also close one or more of the spray nozzles 24, 25 so that water is sprayed only upon a reduced portion of the drum evaporator 11 surface. Since those portions of the surface of the evaporator 11 that are not sprayed with the water pumped through the spray nozzles 24, 25 do not evaporate a significant amount of refrigerant, the heat load on the drum evaporator is reduced by changing the effective heat transfer area of the drum evaporator 11 only to that portion that is sprayed with water, regardless of the level of refrigerant in the evaporator 11.

To control the evaporation rate of the refrigerant, the level in the evaporator 11 may be varied, the water circulation pump 23 may be slowed or stopped, one or more of the water nozzles 24, 25 may be closed to reduce the wetted surface of the evaporator, or a combination of these techniques may be used.